

# Field Guide to the Amphibians of Western India

PART I

BY

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*(With two plates and fourteen text-figures)*

The study of Indian amphibians has not equalled the progress made in recent years in other vertebrate groups. Though the majority of Indian species are now known, the information available on their mode of life and life-history is meagre. A handicap to the student of Indian amphibians is the lack of comprehensive and easily available literature. The FAUNA OF BRITISH INDIA volume on the group was published in 1890, and subsequent papers are scattered over several journals. In these circumstances, it was felt that even the consideration of the status of species occurring within a limited area would be of value to create interest in a very neglected field of study.

Two regions in India have a very rich amphibian fauna, the Western Ghats and the eastern Himalayas. This paper describes the amphibians of the Western Ghats with special reference to species found in the plains and hill areas of Salsette Island and Bombay City and the ghats or hilly areas to the south-east of the City. Most of the common species occurring elsewhere in India are represented here, as well as some genera which are peculiar to the Western Ghats, like *Nyctibatrachus*. The species occurring elsewhere along the length of the Western Ghats are also described including those which I have not observed personally.

I am indebted to Mr. Humayun Abdulali for having interested me in the study of amphibians and for having given me the opportunity of accompanying him on field trips over several years.

These notes include a brief sketch of the natural history of amphibians; characters of external morphology aiding their specific identification; keys for the separation of families, genera, and species occurring in the area of study; and a description of the species. For

the sake of completeness information already available has been compiled.

The amphibians consist of three well-defined types, grouped in three Orders:

- Caudata : tailed salamanders and newts, represented by a single species in the eastern Himalayas;
- Gymnophiona: limbless, snake-like amphibians, represented by five genera and 14 species;
- Salientia : quadruped frogs and toads represented by five families, 18 genera, and 111<sup>1</sup> species.

These Orders have certain characters in common. They are cold-blooded vertebrates having a smooth or rough glandular skin and lacking fur, feather, and/or scales found in dry-skinned, truly land vertebrates. A primitive type of scale occurs embedded in the skin of some caecilians.

The skin of the amphibians has several functions. The numerous glands on the skin keep it moist with their secretion; however, this offers little protection against dessication and consequent death. The frogs and caecilians therefore keep to a moist humid habitat. The toads are comparatively better protected and are able to survive in areas unsuitable for frogs but even a toad restricts its wandering for food to the humid night and seeks a cool retreat in which to spend the hours of daylight. The moist skin also acts as a temperature regulator keeping the body cooler than the surrounding air in dry air and warmer in humid air. Frogs are thus better able to function on a rainy than on a sunlit day. Another effect of this function is noticed in the habitat preference of tree frogs. Small tree frogs which have a large surface area in relation to body weight would lose a larger volume of water through evaporation. They are consequently unable to occupy higher levels of trees where wind promotes a rapid rate of evaporation and are, therefore, usually seen on bushes and lower levels of trees.

The skin glands also protect the animal. They are usually found grouped together as the parotoids in toads, or are seen in ridges as in many species of *Rana*. Their secretion, produced on being provoked, is injurious to the mucus membrane of the eye and mouth of other animals. The action of the poison is said to resemble that of digitalis.

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<sup>1</sup>This figure does not include the 19 species described by C. R. N. Rao in 1937 in the *Proc. Ind. Acad. Sc.* as the type specimens are not now available. The total number of valid species awaits a revision of the Order.

The skin acts as a respiratory organ as well, and the cool wet crannies along stream and pond banks in which frogs hide provide an ideal situation for this function. In addition the skin has a chemical sense which enables amphibians to avoid areas unsuitable for them in their habitat and is also sensitive to light helping the animals to avoid bright sunlight.

Most of the Indian species are sober-coloured, with various shades of brown and grey predominating. Red, which is an uncommon colour in amphibians, is seen in many Indian species. *Microhyla rubra* and *Rana malabarica* have shades of red on the back as a major component of their colour pattern. The common toad (*Bufo melanostictus*) has often a pale red ground colour. Red spots and patches are seen in *Rana rufescens*, juvenile *Rana limnocharis*, and the Microhylid *Kaloula pulchra taprobanica*. The inside of the thighs is bright red during the breeding season in such unrelated species as *Megophrys parva*, and *Philautus annandalii* of the eastern Himalayas, and *Rana beddomii* and *Micrixalus fuscus* of the Western Ghats. The large wrinkled frog *Nyctibatrachus major* is often dull reddish orange, and some specimens of Humayun's Wrinkled Frog *Nyctibatrachus humayuni* almost purplish. The bi-coloured frog *Rana curtipes* has an unusual colour pattern being grey above and black below. Most frogs and toads have the ability to change colour to a certain extent. This character is developed to a remarkable degree in the tree frogs. The Chunam Frog *Rhacophorus maculatus* can change from green to darker shades, and from brown to pale creamish yellow. Low temperature and high humidity tend to darken, and high temperature and dryness to lighten colours. One curious factor in amphibian coloration is the limitation of pattern types seen in the group as a whole. A dark band between the eyes for example appears in several Indian species.

The eye of amphibians is adapted for far sight. The iris is beautifully coloured in many species being often flecked with gold. In the terrestrial frogs and toads and the arboreal tree frogs the eyes are of a large size and placed well above the plane of the head. The burrowing species usually have small beady eyes, and in many caecilians the eye has degenerated and may not be visible above the skin. Frogs and toads have good colour vision and show a preference for green and blue, believed to be in association with their habit of hunting in grass.

The sense of hearing is particularly well developed in most amphibians. The tympanum, which is exposed on the side of the head, is usually circular or oval in shape, and in size equal to or less

than the diameter of the eye. It is not visible externally in many species and may be completely absent along with the middle ear in burrowing forms; however, these are quite receptive to the call of their kind during the breeding season. Hearing also plays a part in the detection of prey. Toads can spot the location of an insect on hearing its call.

The sense of smell, not well developed in adult frogs and toads, is believed to be acute in tadpoles. The burrowing caecilians are peculiar in having tentacles which are connected with the nasal passages and act as tactile noses for conveying smell impressions. Frogs and toads are indiscriminate feeders and have a poorly developed sense of taste but obnoxious material is either left untouched, or voided if taken. The former may be learnt from experience, while the avoidance is helped by the ability of some species to evert their stomach when anything disagreeable is swallowed.

The most remarkable factor in the life of amphibians is their breeding habit. It is a well-known fact that, among land vertebrates, only amphibians begin their lives in water as tadpoles. It is during the breeding season, coinciding with the monsoons in India, that the normally circumspect frogs and toads throw all caution to the winds and the male makes its presence known by its loud call, a sound which, at night in well-watered country, is a continuous roar as thousands of frogs and toads of different species give tongue to advertise their presence in the selected breeding site.

The larynx in the male is divided by the vocal organ in the form of a thickened lip and sound is produced by the vibration of the rim of this lip as air from the lungs is forced into the vocal sacs, which act as resonators amplifying the volume of sound. The lungs and vocal sacs act as a closed system, air being forced back and forth between the two. The call at the breeding season is one of the principal means of guidance for individuals of a species to gather at suitable breeding sites. The noise made by early arrivals guides the late comers. The sense of hearing is acute at this period and experiments have proved that some species can recognise the call of their kind at distances of over 600 yards. The call of each species is distinctive and is a good guide for field identification. Normally the depth of tone is in proportion to the size of the frog, the larger species having a deeper voice, but exceptions occur. Abdulali (1962, *J. Bombay nat. Hist. Soc.* 59 : 236) records the call of *Kaloula pulchra taprobanica* as being shriller than that of the smaller *Ramanella montana*. Several other factors, e.g. condition of the gonads, increased humidity, temperature of the water, moisture

gradient, and odour of aquatic vegetation, influence the arrival of the animals at their breeding grounds. The breeding site is usually a place of clamour and activity with scrambling for position among the males. The normal method of amplexus is for the male to clasp the female with his forelegs around the body behind her forelegs. The male is carried round till the eggs are laid and fertilised. Several factors help the male to recognise the female. Most males embrace any object in movement similar to them or slightly larger in size, but if the embraced object does not have certain characters it is released. These characters are the correct size and firmness, gravid females having distended, tense abdomens. A male, when embraced by another, croaks while females are silent. The breathing movement of the female also stimulates the grasp reflex of the male. Males in amplexus kick vigorously to resist attempts by other males to dislodge them. Several species may breed in the same area but the characters that help reproductive isolation are not fully known. Many frogs and toads emit an odour which is sometimes pungent, but there may also be odours beyond human comprehension which may be of significance in sex and species identity. In two Indian species, this character has been noticed. In *Rana malabarica*, McCann (1946)<sup>1</sup> records an odour similar to that of fungus, and I have noticed an odour akin to that of vulcanised rubber in *Rana curtipes*. In both species the smell was noticed during the breeding season at the onset of the monsoon.

Secondary sexual characters are developed by the males of many species during the breeding season. Spines and callosities are often present on the fingers. As mentioned earlier many have the inside of the thighs bright red. The throat of the male, if the vocal sac is internal, may be black in colour in association with the capacity for enormous expansion of the region during the breeding season. In *Rana beddomii* a granular patch is seen on the inside of the thigh.

The manner of deposition of the eggs varies, many frogs lay them in a frothy mass. Among the tree frogs the eggs are usually not laid in water, but in a situation which would enable the developing young to be released into water. The egg mass hardens into a crust on the outside in these species. The toads lay their eggs in gelatinous strings of varying lengths which are loosely twined round water-weeds by the movements of the female. The number of eggs laid by one female may be as high as 2000+ in Indian species; those which

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<sup>1</sup>McCann, C. (1946) : Strong odour emitted by the fungoid frog *Rana malabarica*. *J. Bombay nat. Hist. Soc.* 46 : 406.

have an abbreviated larval life lay a smaller number varying with the period of the larval life. Eggs, larvae, and breeding habits of many species of Indian amphibia are yet to be described. The tadpoles usually have numerous teeth rows in the mouth area. The number of teeth rows varies in different species and is one of the characters used for identification. The teeth are absent in some species and tadpoles of species breeding in torrential streams often have a circular ventral sucker.

Amphibians are relatively defenceless animals and seek safety in crevices and other shelters when faced with danger or remain immobile depending on their cryptic coloration to escape detection. The skin secretions also give a certain amount of protection, but many predators are immune to their effect. The common toad (*Bufo melanostictus*), for example, is a normal item of food of the Green Keelback (*Macropisthodon plumbicolor*). A method of defence, used mainly by toads, is to inflate the body thus making it difficult for the predator to hold the smooth and swollen body. This reaction is activated by the size and speed of the approaching object. An object the size of a snake's head evokes it, while the approach of a larger body is ignored.

Amphibians are beautifully adapted to life in their particular environment and usually it is possible to 'place' a species by a superficial examination, for instance burrowing species have well-developed metatarsal tubercles, the spades they use for digging, while tree frogs have large adhesive discs, and aquatic species have extensive webbing on the toes.

The bulk of the food consumed by amphibians consists of invertebrates, mainly insects. They also feed on any animal, including others of their kind, which they can overcome.

#### KEY CHARACTERS OF EXTERNAL MORPHOLOGY

The identification of amphibians, particularly the frogs and toads, to even the family level could be difficult to non-herpetologists as there are no marked differences in their external appearance. There are, however, several characters of the external morphology by which the animals can be separated down to the species in the field. These characters are:

1. The skin: As a rule, the appearance of the skin is moist in frogs, and dry and rough with numerous spiny tubercles and warts

in the toads. Tubercles which may be present in frogs are not as prominent as in the toads.

Skin glands are numerous and may occur as a localized mass, as the characteristic Parotoid Glands (Text-fig. 1, *a*) which occur behind the eyes and above the tympanum in almost all toads. The glands also occur as folds or ridges on the skin, the most frequent being a pair of dorso-lateral folds along the flanks (Text-fig. 2, *dl*), supra-tympanic (Text-fig. 3, *st*) from behind the eye to the shoulder, and longitudinal folds of different lengths, parallel to each other or otherwise, on the back (Text-fig. 4). The numerous ridges on the back sometimes give a wrinkled appearance to the skin as in *Nyctibatrachus*.

In some species a row of porous warts analogous to the lateral line organs in fishes are found from near the groin up to the axilla (Text-fig. 5, *pw*). Ventrally the skin is usually smooth but may have varying degrees of granulation on the belly and inside of the thighs particularly in arboreal species. Bony ridges occur on the head of some toads (Text-fig. 1, *b*). In the breeding season the males of many species develop spines and callosities on the hands and sometimes glandular or granular patches on the thighs and breast.

2. **The head:** The shape and the relative dimensions of parts of the head help in identification. These are: the length of the head in relation to its width, the shape of the pupil, vertical, horizontal, or circular (Text-fig. 6); inter-orbital width or the space separating the eyes in comparison to the width of the upper eyelid (Text-fig. 1, *d*), the diameter of the tympanum, if visible, in relation to the horizontal diameter of the eye and its distance from the eye; the distance of the nostril from the eye and the tip of the snout; the shape of the snout and the nature of the canthus rostralis or the angle of the junction of the side and top of the snout (Text-fig. 1, *c*).

3. **The mouth:** The width of the mouth is usually equal to the maximum width of the head. The tongue is attached to the front of the mouth and free behind. It varies in shape being bifid at the end (Text-fig. 7, *b, c*) or entire, oval (Text-fig. 7, *a*), pyriform (Text-fig. 7, *d*), or terminating in a point. A pointed papilla is seen in the middle of the tongue in some species (Text-fig. 7, *b*). The lower jaw is toothless in Indian species and the upper jaw may or may not have teeth. These teeth are minute and difficult to distinguish but can be made out by passing a finger or a needle over the jaw (Text-fig. 8). In addition to these, some genera have two rows of teeth on the inside of the mouth close to the internal opening of the nostrils (Text-

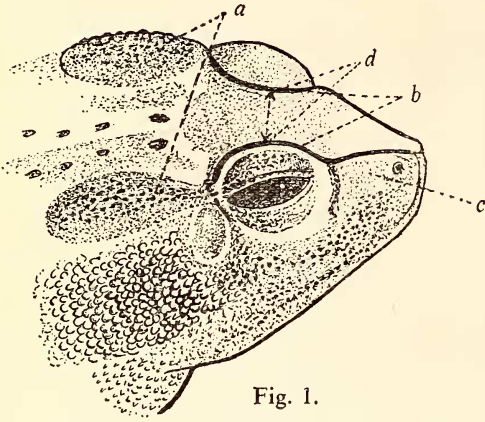


Fig. 1.

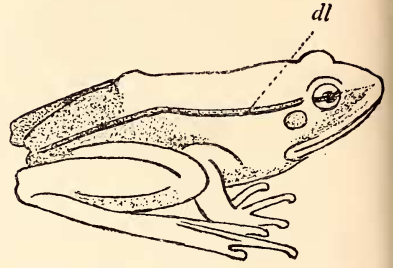


Fig. 2.

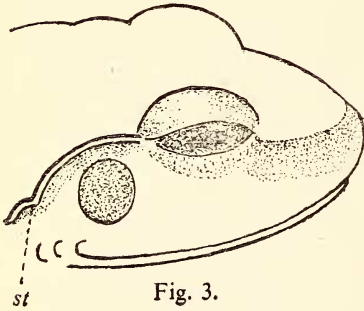


Fig. 3.

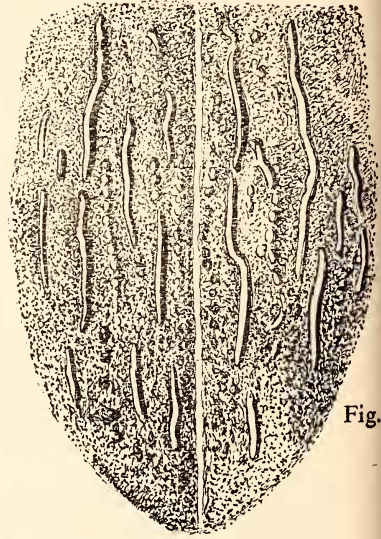


Fig. 4.

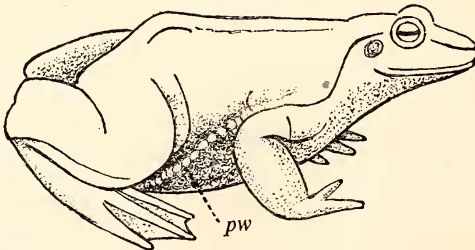


Fig. 5.

Fig. 1. (a) Parotoid glands, (b) Cornified ridges, (c) Canthus rostralis, (d) Inter-orbital width ; Fig. 2. Dorso-lateral fold ; Fig. 3. Supra-tympanic fold ; Fig. 4. Longitudinal folds ; Fig. 5. Porous warts

(Figures diagrammatic)



fig. 9, v). These are the vomerine teeth and their form and position are also useful for identification.

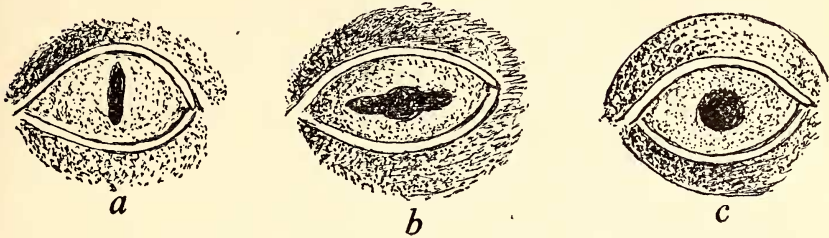


Fig. 6. Shape of the pupil : *a*. vertical, *b*. horizontal, *c*. circular (Figures diagrammatic)

4. The limbs: The forelimbs are always considerably shorter than the hindlimbs in frogs and toads. The hand has four digits the first digit being the one nearest the body. The hindlimbs are very long, particularly so in the frogs and consist of the femur, tibia, tarsus, and foot (Text-fig. 10). The foot has five toes.

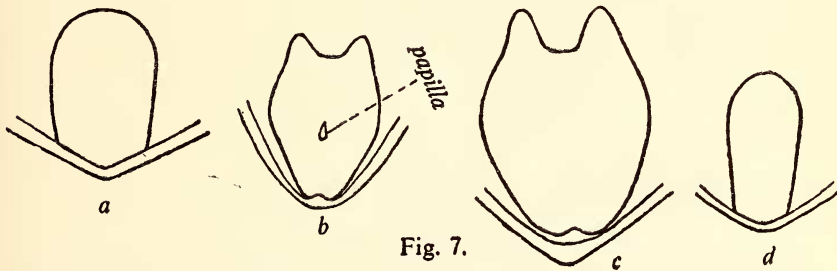


Fig. 7.

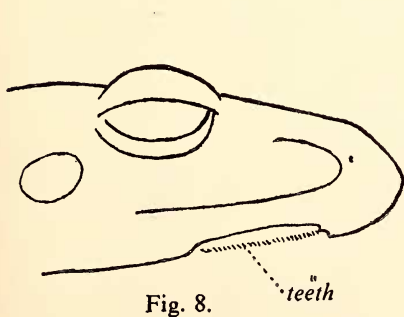


Fig. 8.

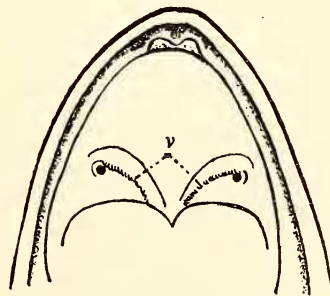


Fig. 9.

Fig. 7. Shape of tongue : *a*. oval, *b*. & *c*. bifid, *d*. pyriform ; Fig. 8. Upper jaw showing row of teeth ; Fig. 9. Palate region showing vomerine teeth (*v*) (Figures diagrammatic)

The characters of the limbs used in diagnosis are:

- (i) The relative lengths of the 1st and 2nd finger,
- (ii) The point reached by the tibio-tarsal articulation (tarso-metatarsal in toads) when the hindlimb is held along the body (Text-fig. 10, *tta*). It may reach the shoulder, the tympanum, the eye, the nostril, the tip of the snout or beyond. The tibio-tarsal articulation is analogous to the human ankle.

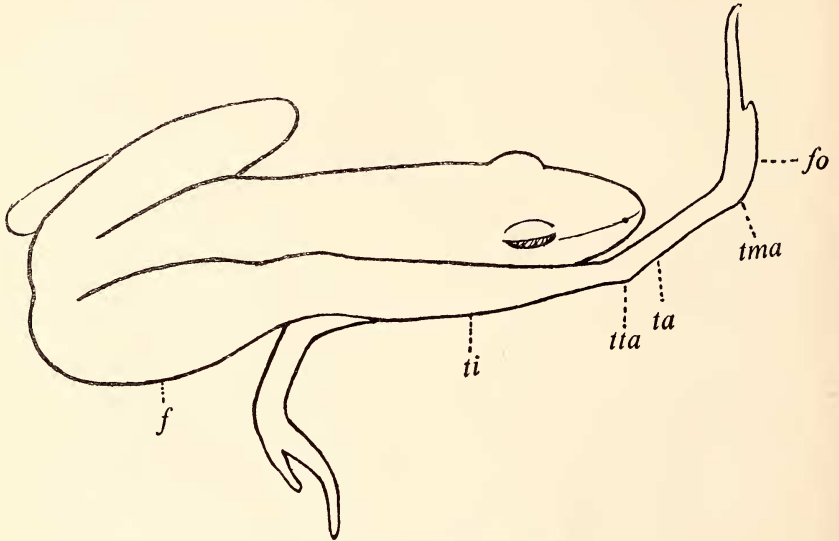


Fig. 10. Parts of the leg : *f*. femur, *ti*. tibia, *ta*. tarsus, *tta*. tibio-tarsal articulation, *tma*. tarso-metatarsal articulation, *fo*. foot  
(Figure diagrammatic)

- (iii) The feet may or may not overlap when the hindlimbs are folded at right angles to the body (Text-fig. 11, *a*, *b*).

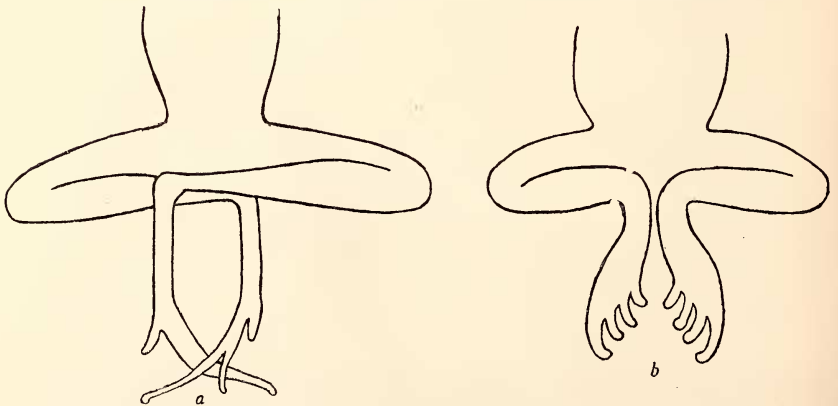


Fig. 11. Position of feet when folded at right angles  
(Diagrammatic)

(iv) The two external metatarsals may be entirely separated by web (Text-fig. 12, *oms*) or attached partly or fully (Text-fig. 12, *omb*). A human analogy would be the separation of the little toe from its neighbour by web up to the ankle.

(v) Tubercles, Sub-articular Tubercles: These are found at the joints of the fingers and toes (Text-fig. 12, *sat*). They may be well developed or weak or absent.

Metatarsal Tubercles: Two tubercles occur on the heel of the foot (Text-fig. 12, *imt*, *omt*), the inner metatarsal tubercle constantly and the outer metatarsal tubercle occasionally. The inner tubercle varies in size and shape and is very prominent and crescentic in burrowing species (Text-fig. 12, *f*).

(vi) Webbing: The degree of webbing of the fingers and toes is of importance. The digits may be  $\frac{1}{4}$ ,  $\frac{1}{3}$ ,  $\frac{1}{2}$ ,  $\frac{2}{3}$ ,  $\frac{3}{4}$ , or fully webbed or the webbing may be rudimentary or absent (Text-fig. 12, *c*, *f*, *d*, *g*, *e*, *a*, *b* respectively). In many aquatic species the web extends as a fringe along the outer toe up to the tarsus (Text-fig. 12, *fr*).

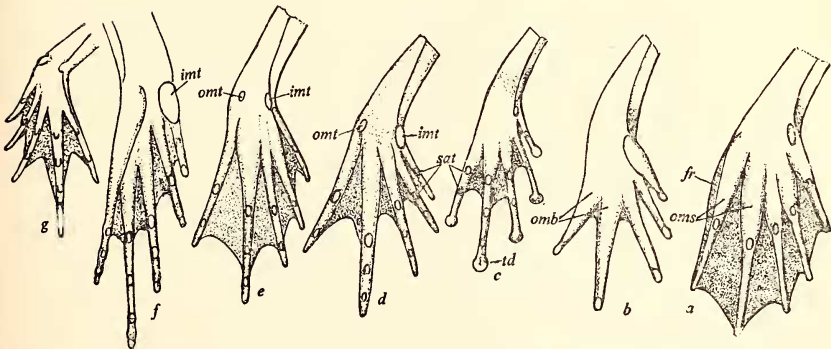


Fig. 12. Foot characteristics : *fr*. fringe, *oms*. outer metatarsals separated by web, *omb*. outer metatarsals bound, *sat*. sub-articular tubercles, *imt*. inner metatarsal tubercle, *omt*. outer metatarsal tubercle, *td*. toe disc

(vii) Finger and toe discs: The tips of the digits are usually obtuse, but in the tree frogs and several torrent-dwelling species, the tip is enlarged into a circular adhesive disc. The tree frogs (Rhacophoridae) also have an additional cartilaginous phalange between the two distal phalanges

(Text-fig. 13, *a*) which gives a characteristic bend to the digits. In many torrent-dwelling Ranidae a circum-marginal groove is found along the side of the disc (Text-fig. 14, *cm*).

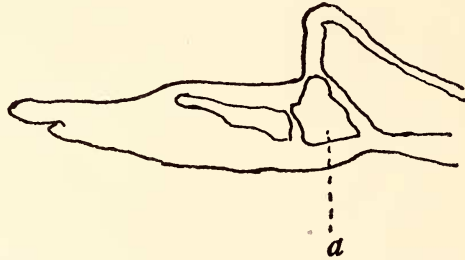


Fig. 13. Toe of tree frog showing additional cartilaginous phalange (*a*) (Diagrammatic)



Fig. 14. Circum-marginal groove (Diagrammatic)

KEY TO THE FAMILIES OF AMPHIBIANS OF WESTERN INDIA

- |  |               |
|--|---------------|
| 1. Limbs absent ; body snake-like ..   | Caecilidae    |
| Limbs present ; without tail in adult ..   | 2             |
| 2. Upper jaw toothed, tongue bifid <sup>1</sup> (Text-fig. 7, <i>b</i> & <i>c</i> , and 8) ..              | 3             |
| Jaws toothless, tongue entire (Text-fig. 7, <i>a</i> & <i>d</i> ) ..                                       | 4             |
| 3. Digits with an intercalary cartilage between penultimate phalanges (Text-fig. 13, <i>a</i> ) ..         | Rhacophoridae |
| Digits without intercalary cartilage ..  | Ranidae       |
| 4. Pupil horizontal (Text-fig. 6, <i>b</i> ), tongue pyriform (Text-fig. 7, <i>d</i> ), skin tubercular .. | Bufo          |
| Pupil circular (Text-fig. 6, <i>c</i> ), tongue oval (Text-fig. 7, <i>a</i> ), skin smooth ..              | Microhylidae  |

Family CAECILIDAE: Caecilians

Fossorial, limbless amphibians, snake-like in general appearance, for which they are often mistaken. The head, except for the lack of annulations, is not distinguished from the body. The eyes may or may not be visible externally. There is a short tentacle on each side of

<sup>1</sup> Except in the genus *Ooeidozyga* of Ranidae, which genus does not occur in W. India.

the head between the eye and the nostril. The mouth is armed with teeth. The body has a series of annulations. A short tail may be present or absent. The caecilidae are the most primitive among the amphibians and are found only in the tropical regions of Asia, Africa, and America. Very little is known of these secretive creatures.

Five genera occur in the Indian region and of these *Herpele* is restricted to eastern India, *Gegeneophis*, and *Uraeotyphlus* to south-western India, and *Indotyphlus* is known only from the type locality, Khandala and the neighbourhood of Lonavla in the Western Ghats, 75 miles south-east of Bombay City. The genus *Ichthyophis* is widely distributed being found all along the Western Ghats from the Dangs southwards and also in some areas of the Eastern Ghats and north-east India. Its extralimital distribution extends to the Philippines. It is likely that *Ichthyophis* as well as other genera may occur in suitable areas in other parts of the country, particularly the hills of central India. Their distribution is, however, restricted to areas with good rainfall.

A key to the Indian genera of the family as well as to the species of Indian *Ichthyophis* has appeared in a recent issue of the *Journal* [Taylor, 1961, 'Notes on Indian Caecilians', *Vol. 58* (2) : 355-365]. Of the other three genera, which occur in south-west India, *Indotyphlus* and *Gegeneophis* are monotypic; therefore, only a key to species of *Uraeotyphlus* is included here.

#### Genus *Indotyphlus* Taylor 1960

##### *Indotyphlus battersbyi* Taylor 1960

*Diagnosis.* A slender caecilian, uniform light brown in colour, distinguished by its transverse anus and absence of tail.

*Habits.* During the rains (June to September) the animal lives under stones on the grassy hill-sides at Khandala. It has not been collected at any other season. In its slender girth and colour it bears a striking resemblance to the earthworm which occurs with it in its habitat, but the caecilian can be distinguished by its distinctive head.

Breeding habits and larvae unknown.

#### Genus *Gegeneophis* Peters 1879

##### *Gegeneophis carnosus* (Beddome) 1870

*Diagnosis.* A slender species similar in dimensions to *Indotyphlus* which it also resembles in its uniform flesh colour. However, the head is yellowish in colour and the eyes are not visible. Tentacle

globular surrounded by a circular groove and situated behind and below the nostril.

*Distribution and habits.* Originally collected under stones at Peria Peak in the Wynaad, Malabar. The species has also been reported further south in Kerala from Kallar (500 ft.) at the foot of the Ponmudi Hills (Ferguson 1904)<sup>1</sup>, Tenmalai and Trifandru at sea-level (Seshachar 1942)<sup>2</sup>. The species thus has a considerable altitudinal range and its distribution is perhaps influenced only by climatic conditions.

*Breeding habits.* A large number of adults with their eggs were taken from burrows by the side of small hill streams at Tenmalai, Kerala, by Seshachar (1942) who records that the egg clusters of about 15 eggs each resembled *Ichthyophis* eggs but with the difference that in this species the filaments connecting the eggs were not twisted together as in *Ichthyophis*, and also in the embryos having only two well-developed gills, the third being rudimentary or absent.

#### Genus *Uraeotyphlus* Peters 1879

*Diagnosis.* Distinguished from *Indotyphlus* and *Ichthyophis* by the tentacle being closer to the tip of the snout than to the eye and from *Gegeneophis* by the presence of eyes.

#### KEY TO THE SPECIES OF *URAEOTYPHLUS* PETERS 1879

150-177 folds or annulations round the body	..	<i>narayani</i>
195-197           "           "	..	<i>menoni</i>
200-210           "           "	..	<i>oxyurus</i>
240-260           "           "	..	<i>malabaricus</i>

#### *Colour in life size*

*Uraeotyphlus narayani* B. R. Seshachar 1939: Steel grey, ventrally pale flesh-coloured except on the throat and also posteriorly where it is dark. A pale spot round the vent.

*Uraeotyphlus menoni* N. Annandale 1913: Slate grey above, paler on lips and throat; ventrally white blotched with slate grey. A pale spot round the vent.

*Uraeotyphlus oxyurus* (Dum. & Bibr.) 1854: Blackish or purplish brown, lighter sometimes, white beneath lip and on folds on side. Length 11 inches, diameter 0.5 in.

<sup>1</sup> Ferguson, H. S. (1904) : A list of Travancore Batrachians. *J. Bombay nat. Hist. Soc.* 15 : 499.

<sup>2</sup> Seshachar, B.R. (1942) : The eggs and embryos of *Gegeneophis carnosus* Bedd. *Curr. Sci.* 11 : 439.

*Uraeotyphlus malabaricus* (Beddome) 1870: Dark olive-brown above, slightly paler below. Lips and tip of snout yellowish. Length 9 in., diameter 0.3 in.

Very little information is available on these animals. *U. oxyurus* is perhaps the commonest species. The type locality of *U. oxyurus* and *U. malabaricus* is given as 'Hills of Malabar', but several specimens of the former are recorded from Cochin which is also the type locality of *U. menoni*. This species has also been collected at Koduvalli, 13 miles north of Calicut [Elayidom *et al.*, 1963, *Curr. Sci.* **32** (6) : 274]. The type locality of *U. narayani* is Kannam, 16 miles from Kottayam, Kerala.

Breeding habits and larvae are unknown.

### Genus *Ichthyophis* Fitzinger 1826

Six species occur in western and south-western India. These are:

- (i) *Ichthyophis bombayensis*: Surat Dangs (Waghai).
- (ii) *I. subterrestris*: Alibag, Kolaba District. (across the harbour from Bombay City); Anamalai Hills, Kottayam, Kerala.
- (iii) *I. beddomii*: Gersoppa, N. Kanara; Nilgiris; Kerala.
- (iv) *I. peninsularis*: Malabar, Kerala.
- (v) *I. tricolor*: Nilgiris; Peermade, Kerala (T. L. Maddathori).
- (vi) *I. malabaricus*: Maduvangard, Kerala.

The seven species (including *I. sikkimensis* of the eastern Himalayas) of Indian *Ichthyophis* described by Taylor were formerly grouped under *I. glutinosus* and *I. monochrous*, and the available information on their habits perhaps refers to one or the other of several species. However, as the *Ichthyophis* have very similar habits, the notes given below can be considered as typical for the genus.

These caecilians are not uncommon in well-watered country, particularly in the hill areas and are also the most well known among Indian Gymnophiona. According to Seshachar *et al.* (1932)<sup>1</sup>, specimens have been collected from under rocks, fallen tree trunks, decaying vegetation, dilapidated houses, and under hayricks. They have limited burrowing capacity useful only in soft moist earth, and in dry months live under stones and rotten wood. On moist ground they can move quickly and are difficult to capture. Abdulali (1954)<sup>2</sup> records the

<sup>1</sup> Seshachar, B. R., & Muthuswamy Iyer, M. S. (1932) : The Gymnophiona of Mysore. *Half Yearly Journal, University of Mysore* (6) : 170.

<sup>2</sup> Abdulali, H. (1954) : Distribution and habits of the Batrachian *Ichthyophis glutinosus* Linn. *J. Bombay nat. Hist. Soc.* **52** : 639.

movement of *I. beddomii* 'as a series of ripples reminiscent of a millipede rather than a snake or eel'. They swim well with horizontal movements like a snake but are uncomfortable in water. Under provocation the skin exudes a cream-coloured secretion with the smell of musk. While moving the tentacles are constantly protruded and retracted. They are essentially solitary animals.

Their main food appears to be earthworms (Wall 1922)<sup>1</sup>, but they are also known to take termites and small earthsnakes.

*Breeding.* The main period is between March and September. The eggs are few in number and large-sized, about 10 mm. in diameter. Each egg has a filament and the filaments of a clutch are twisted together. The mother after laying the eggs in a burrow near water, coils around them and gives a certain amount of protection during development. The caecilians provide the only instance of parental care among Indian amphibians. The larvae are found in small hill streams.

#### Family BUFONIDAE: Toads

Nine species grouped under three genera are recorded from Western India.

#### KEY TO THE GENERA OF BUFONIDAE

- |   |                       |
|---|-----------------------|
| 1. Parotoid glands absent (Plate I, fig. 1)           | .. <i>Ansonia</i>     |
| Parotoid glands present (Text-fig. 1, a)              | 2                     |
| 2. Fingers webbed, discs present (Plate I, fig. 4, a) | .. <i>Nectophryne</i> |
| Fingers free, no discs (Plate II, fig. 1)             | .. <i>Bufo</i>        |

#### Genus *Ansonia* Stoliczka 1870 : Torrent Toads

The generic characters are: Head without cranial ridges; parotoid glands absent; skin with small tubercles, finger and toe tips swollen; toes fully webbed; eggs unpigmented, large-sized (2+ mm. diameter as compared to 1+ mm. in *Bufo*); less than 250 per clutch (1000+ in *Bufo*). Tadpoles which are found in hill-streams have a large sucker-like oral disc (Inger 1954)<sup>2</sup>.

<sup>1</sup> Wall, F. (1922) : Report on some lizards, frogs and human beings in the Nilgiri Hills. *J. Bombay nat. Hist. Soc.* 28 : 493.

<sup>2</sup> Inger, R. F. (1954) : Systematics and Zoogeography of Philippine Amphibia. *Fieldiana, Zool.*, 33 (4) : 239.



**Ansonia ornata** Günther 1875 : Malabar Torrent Toad*Bufo pulcher* Boulenger 1882.

(Plate I, Fig. 1, 2)

*Diagnosis.* A small (30 mm. head to vent length) slender toad with distinct tympanum, half the diameter of the eye. Parotoids absent. First finger shorter than second; toes almost fully webbed; tibio-tarsal articulation reaches to between eye and tip of snout; skin of back finely granular on anterior half only.

*Colour.* Black with greyish head or with greyish spots on head and a grey dorsal line; ventrally black with bright yellow spots.

*Distribution.* This species has been recorded only from the Brahmagiri Hills in Coorg, Mysore State.

Breeding habits and larvae unknown.

Allied species which occur in Malaya and the Philippines live in and near the hill streams where they breed. The tadpoles with their sucker-like mouth discs are adapted for life in hill torrents.

**Genus Nectophryne** Buchholz & Peters 1875 : Tree Toad**Nectophryne tuberculosa** (Günther) 1875 : Malabar Tree Toad

(Plate I, Fig. 3, 4)

*Diagnosis.* A slender, small (35 mm. head to vent length) toad with the tips of fingers and toes dilated into truncated discs. Tympanum distinct,  $\frac{1}{3}$  diameter of eye. Parotoids present. Fingers webbed at base; first finger half the length of the second. Toes almost fully webbed. Skin of back tubercular with the largest tubercles in two rows on the sides of back. Colour brownish grey above with darker sides. A white band from below the eye to the shoulder and another on the flank. Below whitish spotted with black.

*Distribution.* Malabar.

Habits and larvae unknown. An allied species in Malaya *N. hosii* has been observed on bushes and small trees near water during the breeding season. The eggs of the Malayan species are laid in strings.

Several species of the genus occur in Africa and south-east Asia. Two are known from India, *N. tuberculosa* and *N. kempi* Boulenger 1919 from Garo Hills, Assam, which has the tympanum hidden.

Genus **Bufo** Laurenti 1768 : Toads

Toads are easily recognised by their warty skin and the presence of two well-marked glands behind the head, the parotoid glands. They are true land animals and except for the breeding season are not seen in water. They have a world wide distribution but are not found in areas where the ground is permanently frozen and are also absent in Australasia, and in some oceanic islands.

Seven species occur in western and south-western India.

KEY TO THE SPECIES OF *BUFO* LAURENTI 1768

- |  |                         |
|--|-------------------------|
| 1. Head without bony ridges (Plate II, fig. 5)   | .. 2                    |
| Head with bony ridges (Plate II, fig. 1)   | .. 3                    |
| 2. Tympanum nearly as large as eye, toes webbed at base<br>(Plate I, fig. 5)                             | .. <i>hololius</i>      |
| Tympanum $\frac{2}{3}$ diameter of eye, toes $\frac{2}{3}$ or $\frac{1}{2}$ webbed<br>(Plate II, fig. 5) | .. <i>stomaticus</i>    |
| Tympanum very small or indistinct, toes fully webbed   | .. <i>beddomii</i>      |
| 3. Parietal ridges present (Plate II, fig. 7a)   | .. 4                    |
| Parietal ridges absent (Plate II, fig. 1)  | .. 5                    |
| 4. Size large ; first finger longer than second  | .. <i>parietalis</i>    |
| Size small ; first finger equal to second  | .. <i>fergusonii</i>    |
| 5. Tympanum $\frac{2}{3}$ diameter of eye (Plate II, fig. 1)   | .. <i>melanostictus</i> |
| Tympanum small less than $\frac{1}{2}$ diameter of eye (Plate II,<br>fig. 4)                             | .. <i>microtypanum</i>  |

**Bufo hololius** Günther 1875

(Plate I, Fig. 5)

*Diagnosis.* A small toad, 38 mm. in snout to vent length, without cranial ridges. Distinguished by its large tympanum nearly as large as the eye and slightly webbed toes. First finger slightly longer than second.

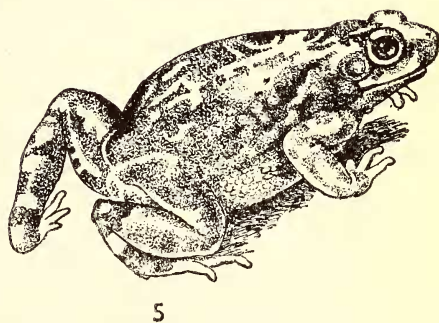
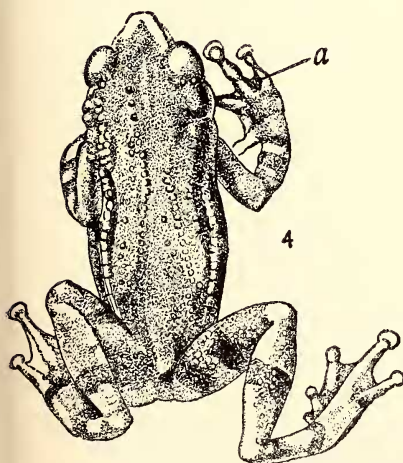
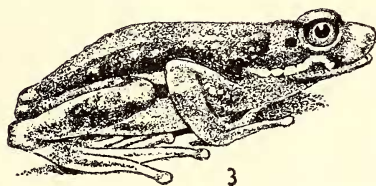
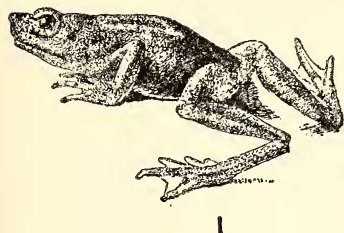
Skin with flat glandular patches. Colour olive-brown above marbled with brown, immaculate white below.

This species is uncommon. It has been reported from Malabar, Kerala. Habits and larvae are not known.

**Bufo beddomii** Günther 1875 : Beddome's Toad

*Diagnosis.* A small toad 41 mm. in head to vent length, distinguished by its very small rather indistinct tympanum and entirely webbed toes. First finger equal to or less than the second in length.

Skin tubercular, brown above with indistinct black spots, limbs marbled with carmine and ventrally marbled with brown.



1 and 2. *Ansonia ornata*; 3 and 4. *Nectophryne tuberculosa*; 5. *Bufo hololius*  
(Sketches after Günther, 1875)

(Magnification of all figures :  $\times c. 1\frac{1}{2}$ )

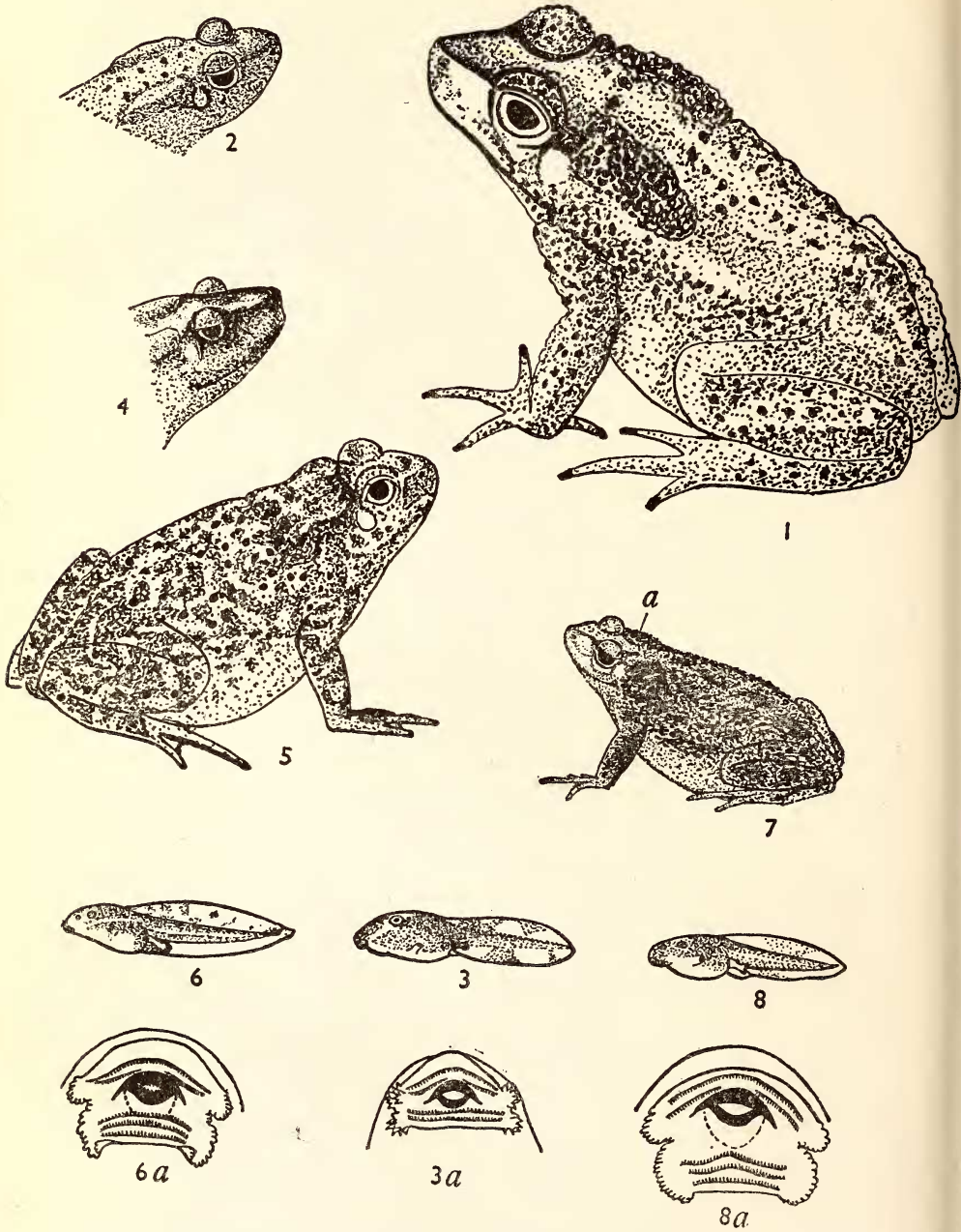


Fig. 1, 2, and 3. *Bufo melanostictus* ; 4. *Bufo microtypanum* ; 5, 6, and 6a *Bufo stomaticus* ; 7, 8, and 8a, *Bufo fergusonii*

NOTE : Fig. 2 :  $\times 3$  ; rest  $\times 1$ , except 3, 6, and 8 :  $\times c. 2\frac{1}{2}$  ; 3a, 6a, and 8a : Mouth parts of tadpoles (diagrammatic). Colour in life : 3 : uniform black ; 6 : black with silver spots ; 8 : dark brown

A rare toad recorded from the Travancore Hills, Kerala, between 2500 ft. (where Beddome collected a specimen under an old rotten log in dense forest) and 4500 ft.

**Bufo stomaticus** Lutken 1862: Marbled Toad

(Plate II, Fig. 5, 6, 6 a)

*Diagnosis.* Medium-sized (76 mm. in head to vent length when adult). Tympanum distinct,  $\frac{2}{3}$  diameter of eye, vertically oval or circular. First finger longer than the second. Toes about  $\frac{2}{3}$  webbed, tarso-metatarsal articulation reaches to between the shoulder and eye. Two equal-sized metatarsal tubercles with sharp edges.

Skin may be smooth with a few flattened tubercles or heavily tuberculated. Crown of head above parotoid glands smooth or with a few scattered tubercles. A row of white tubercles along the outer aspect of the forearm, ventrally coarsely granular but with the chin and throat smooth.

*Colour.* Grey or olive above, rarely uniform but more often with darker marblings. Ventral side and upper lip white. Juvenile toads are light brown with darker marblings which have a pale pinkish centre. This colour pattern helps to distinguish this species from the dark grey or almost black juvenile *B. melanostictus* of similar age group. The juvenile coloration may be seen in specimens up to 30 mm. in snout to vent length. The male has a bright yellowish tint during the breeding season.

The male has a subgular vocal sac and has black cornified patches on the inner aspects of the first and second fingers during the breeding season.

*Breeding.* The toads breed in the Bombay area from June after the onset of the monsoon and tadpoles at different stages of development are available up to August. Within the City they have been observed breeding in shallow rainwater pools in the Backbay area, often about a hundred yards from the sea. The call of the male is distinctive and easily distinguished from that of the common toad (*Bufo melanostictus*). The anplexis is axial. The eggs are laid in translucent strings, pale yellowish green in colour. The tadpoles are small. The coloration is distinctive, being black with shiny silvery spots on the body. The metamorphosed young measures less than 10 mm. in snout to vent length.

*Distribution.* West Pakistan, India (no records from the west coast, except Bombay), Nepal, Ceylon.

*Habits.* This toad is equally at home under varying climatic conditions but appears to be commoner in dry areas and under semi-desert conditions. It occurs up to 6000 ft. in the Nepal Himalayas and is believed to replace *Bufo melanostictus* above 3000 ft. in the hills of Waziristan. They are nocturnal but during the breeding season can be seen moving around during the day. In areas of scanty rainfall they aestivate during the summer. C.R.N. Rao (1923)<sup>1</sup> records that a specimen was unearthed from 4 ft. underground in Waziristan. In Kutch, McCann (1938)<sup>2</sup> observed these toads visiting a pool to spend some time in it before setting out on their nightly rounds, presumably to replace the water they may have lost during the day. Usually solitary, but if kept together in captivity they have the curious habit of resting all together in a jumbled heap. They burrow easily in wet or sandy soil, using their metatarsal tubercles for the purpose. In captivity they fed on termites but refused larger prey.

*Related species.* *Bufo stomaticus* has been confused with *Bufo andersoni*, the Arabian Toad but can be distinguished from it by the absence of a tarsal fold and by the tadpoles being black instead of yellowish. A race was described from Mysore by C. R. N. Rao. Examination of a large series from Bombay proves that the racial characters described by Rao are covered by individual variations.

### ***Bufo parietalis* Boulenger 1882**

*Diagnosis.* A medium-sized (85 mm.) toad distinguished by the presence of parietal ridges from other toads of similar size. First finger longer than second. Tympanum  $\frac{2}{3}$  diameter of eye, toes half webbed. Parotoids prominent. Colour brown above and marbled with brown on white ventrally.

*Distribution.* Originally recorded from Malabar. According to Ferguson, the toad is confined to the hills in the Travancore area of Kerala, where it may be seen up to 3000 ft.

Breeding habits and tadpoles not known.

### ***Bufo fergusonii* Boulenger 1892 : Ferguson's Toad**

(Plate II, Fig. 7, 8, 8 a)

*Diagnosis.* A small toad hardly exceeding 46 mm. when adult. Distinguished from *Bufo parietalis* by its small size, weak cranial ridges, and in the first and second fingers being equal.

<sup>1</sup> Rao, C.R.N. (1923) : Notes on a collection of Batrachia from S. Waziristan. *J. Bombay nat. Hist. Soc.* 29 (1) : 131.

<sup>2</sup> McCann, C. (1938) : The Reptiles and Amphibia of Cutch State. *ibid.* 40 (3) : 427.

Colour olive-brown or reddish with darker markings on the legs.

*Distribution.* The species was originally recorded from Trivandrum, Kerala. It is now known from North Kerala, Mysore, Madras, and Ceylon.

*Breeding.* The tadpole of this species has been recorded by Annandale from coastal pools in southern Kerala. They are distinguished from the tadpoles of *B. melanostictus* occurring in the same area by their smaller size, relatively larger nostrils, and brownish instead of black colour.

*Habits.* According to C. R. N. Rao (1915)<sup>1</sup> this toad is entirely nocturnal and rather rare. It has good capacity for burrowing and specimens kept by him fed exclusively on white ants.

### ***Bufo melanostictus* Schneider 1799 : Common Indian Toad**

(Plate II, 1, 2, 3, 3 a)

*Diagnosis.* This is the largest among Indian toads reaching a snout to vent length of up to 150 mm. and is only equalled in size by the closely allied *Bufo himalayanus* of the Himalayas. Cranial ridges prominent, these as also the upper lip, tips of fingers and toes, metatarsal tubercle, and tubercles on the palm of the hand have black cornifications in the adult. (These tend to peel off in preserved specimens.) Parotoid glands large and prominent. Tympanum distinct, oval or circular in shape,  $\frac{2}{3}$  diameter of eye. First finger equal to or longer than second. The skin is heavily tuberculated and has many black spine-tipped warts. Two series of large warts along the middle of the back, which has otherwise very few tubercles. Crown of head smooth, especially in the larger specimens, or with a few tubercles.

Uniform grey of various shades, brown or reddish with darker markings, ventrally uniform white or speckled with black on the chin and throat.

*Juvenile.* Dark grey or black or reddish brown above, and ventrally uniform white or speckled with black. The juvenile common toad is likely to be confused with species without cranial ridges as these do not appear till the toad attains a snout to vent length of over 20 mm. (Plate II, fig. 2). The ridges are rather indistinct in specimens of up

<sup>1</sup> Rao, C.R.N. (1915) : Some South Indian Batrachia. *Rec. Ind. Mus.* 11 : 31.

to 30 mm. length and are cornified only in specimens with a snout to vent length over 35 mm.

*Secondary sexual characters.* The throat of the breeding male is light orange or yellow in colour, very evident when the vocal sac is distended. The male also has cornified callosities on the inner aspect of the first and second fingers during the breeding season.

*Distribution.* Oriental region and Malaysia.

*Breeding.* This species is a very prolific breeder. A single female may lay over a thousand eggs, in any convenient patch of water. An excellent description of its breeding habits has been given by McCann (1928)<sup>1</sup>. In the Bombay area, after the first heavy fall of the monsoon rains, the characteristic call of the male, resembling the noise produced by a child's horsehair rattle<sup>2</sup> can be heard in the vicinity of ponds, streams, and rainwater pools. The male, which may be considerably smaller than the female, is very much on the alert at this period, calling from a stone or other vantage point near the water and investigating any movement of other toads in its immediate vicinity. At the approach of a female, several males will scramble around her, the whole group at times resembling a rugby scrum with the female buried under a mass of struggling, kicking males, till one among them is successful in holding on to her with the arms clasping the body of the female behind her forelimbs. The callosities on the fingers permit a non-skid grip. With a male thus firmly established on her back the female enters the water to lay. If the amplexus happens away from water it may be continued till water is available which may be even after several days. McCann (*supra*) records one instance where it was continued for 21 days—this was, however, in captivity. The eggs are laid embedded in a translucent string, which is twisted round the stems of grass and other plants in water by the movements of the animals. In the absence of plants the eggs lie in long strings at the bottom of the pond or stream.

The tadpoles, which are uniform black in colour, hatch in about four days after laying. They are usually gregarious and are omnivorous in diet. They move usually at the surface and feed at the edge of the water, mainly on algae and other plant life, but I have also observed them, in a garden tank, feeding on dead toads which had drowned when unable to get out of the tank.

<sup>1</sup> McCann, C. (1928) : Notes on Indian Batrachians. *J. Bombay nat. Hist. Soc.* 36 (1) : 154.

<sup>2</sup> An indigenous toy made from horse hair with a weight at one end of the hair, while the other is looped to a groove on a wooden handle.